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PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Double-row Self-aligning Ball-bearing

We, ROULEMENTS À BILLES MINIATURES S.A., a joint-stock Company duly organized under the laws of Switzerland, residing at Rue du Faucon 19, Bienne, Canton of Berne, Switzerland, do hereby declare the nature of this invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

It is well-known that in certain apparatus, specially in gyroscopes, the friction of the bearings must be reduced as much as possible, in order to avoid detrimental changes in the working conditions of the device. Sensibility and precision of those apparatus must be very great, so that it becomes necessary to prevent the working of the apparatus from being influenced by dilations caused by variations of temperature.

The object of the present invention is to provide an improved double-row, self-aligning ball-bearing for radial and axial loads which will fulfil these conditions.

According to the invention a ball-bearing having a single inner track member and two outer track members separated from each other by an elastic intermediate layer is distinguished by the feature that all points of contact of the balls of each row lie on the curved surface of an imaginary cone having its apex in the axis of the inner track member, the relative axial positions of the two outer track members when the intermediate layer is compressed being such that the apexes of said imaginary cones coincide.

The accompanying drawing illustrates, as an example, two embodiments of the ball-bearing according to the invention.

Fig. 1 shows a bearing with spherical outer races and an inner track-member with two grooved races for the two rows of balls.

Fig. 2 shows a bearing with a spherical inner track-member and with two outer races having a curved profile with a slightly larger diameter than the balls running on them.

In Fig. 1 the outer rings 1 and 1^1 have spherical races 7, 7^1 of different diameter and are located in a casing, not shown, of any desired form, which casing may be attached to any device, for instance, to the supporting frame of the suspension arrangement of a gyroscope. When the ball-bearing is adjusted, the spherical races 7, 7^1 are in exact concentric position to each other with their centres in point 2. The two rows of balls 4 and 4^1 also run in race grooves 5 and 5^1 of an inner track-member 6. The positions occupied by the two rows of balls on their outer races 7 and 7^1 depend on the diameters of the races 5 and 5^1, which diameteres may be equal or different, as may be required. In any case the inner and outer points of contact of the balls of each row lie on the curved surface of an imaginary cone having its apex in the axis of the single inner track member 6. A flexible intermediate piece 3 is provided between the outer rings 1, 1^1. This piece may be a spring or an intermediate layer made of elastic material, such as elastic synthetic resin, e.g. the substance known under the registered trade mark "Plexigum", synthetic caoutchouc, etc. The thickness of this intermediate piece in the non-compressed state is larger than when compressed, i.e., when the bearing is adjusted. When, on assembling the bearing shown in Fig. 1, the several parts have been inserted into the casing not shown, the adjusting device which may, e.g., be formed as a screw-nut not shown, is screwed to an internal thread of the casing, whereby the intermediate piece 3 is compressed to such an extent that rings 1, 1^1 are in concentric position to each other, i.e. the apexes of the two imaginary cones of the two ball rows coincide at the point 2. In this position the bearing provides the indispensible minimum play. The pressure transmitted in this state of adjustment from the intermediate piece 3 to the adjusting device suffices to lock this latter.

The embodiment shown in Fig. 2 differs from that of Fig. 1 in the fact that the inner track-member is a spherical member 6 and that the outer rings 1, 1^1 have race grooves 7, 7^1 of curved cross section, the radius of the curve being only slightly greater than the radius of balls 4 and 4^1.

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The diameters of the two grooves may be equal or different. Spheric track-member 6, which may be a ball of high precision, may, e.g., be held between two supports not shown, these supports being provided with concave surfaces touching ball 6. These supports may be held in a frame not shown and pressed against the ball 6 by screws not shown. Here, too, the inner and outer points of contact of the balls of each row lie on the curved surface of an imaginary cone with its apex in the axis of the single inner track member 6. Thus in this embodiment, too, the minimum play of the bearing may be adjusted by means of an adjusting device similar to that described in relation to Fig. 1, i.e., a device bringing the apexes of the two imaginary cones of the two ball rows into coincidence.

The well-known suspension member for a gyroscope may, e.g., be placed, on the one side, on a bearing of the species shown in Fig. 1 but with the modification that the balls of both rows are of the same diameter and, on the other side, on a cylindrical ball-bearing of a known type and with great axial play. This manner of placing the suspension member has the advantage that, by means of the bearing according to the invention, the suspension member is pivotally mounted with the indispensable minimum-play, but that, in spite of this minimum-play, and owing to the great axial play of the cylindrical bearing, dilations caused by variations of temperature have no detrimental effect on the working of the suspension-device of the gyroscope. This is not possible with the oblique ball-bearings hitherto known, which often cause a braking of the device.

The bearing according to the invention may also be used in the centre of the gyrostat of a gyroscope. In this case the spheric track-member 6 of Fig. 2 and the spheric outer races 7, 7^1 of Fig. 1 are preferably used with the modification that the balls of both rows are of the same diameter. In this case of concentric spherical inner and outer races care must be taken that the two ball-rows do not touch each other. For this purpose a ball-cage with two rows of holes receiving the balls of the two rows is provided. For adjusting the play of the bearing a device similar to that described in relation to Fig. 1 that is, a screw nut engaging a thread of the casing may be used. Here, too, the working of the apparatus is in no way influenced by variations of temperature.

After having taken the bearing to pieces, the re-assembling and re-adjusting, owing to the elasticity of the intermediate piece 3, can be carried out without any difficulty and with the same precision as if the bearing were new.

Having now particularly described and ascertained the nature of our said invention, and in what manner the same is to be performed, we declare that what we claim is:—

1. Double-row, self-aligning ball-bearing for radial and axial loads and having a single inner track member and two outer track rings separated from each other by an elastic intermediate piece, characterised in that the points of contact of the balls of each row lie on the curved surface of an imaginary cone having its apex in the axis of the inner track member, the relative axial positions of the two outer track members when the intermediate layer is compressed being such that the apexes of said imaginary cones coincide. and with spherical outer track-rings, characterised in that the spheres of these outer rings have different diameters.

2. Ball-bearing according to claim 1 characterised in that the races of the outer track-rings are grooves and have either equal or different diameters.

4. Ball-bearing according to claim 1, characterised in that the single inner track member is a ball.

5. Ball-bearing according to claim 1, characterised in that the races of the single inner track member are grooves whose median diameters are either equal or different.

Dated this 9th day of April, 1940.

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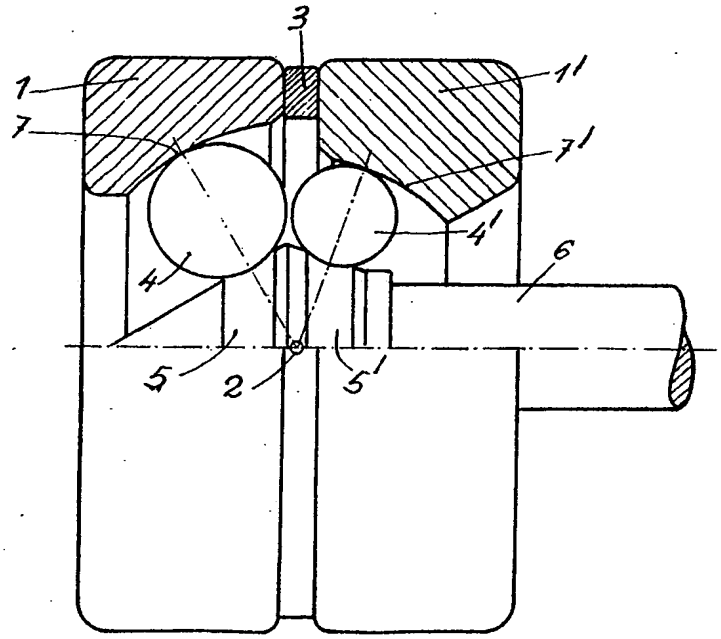

Fig. 1.

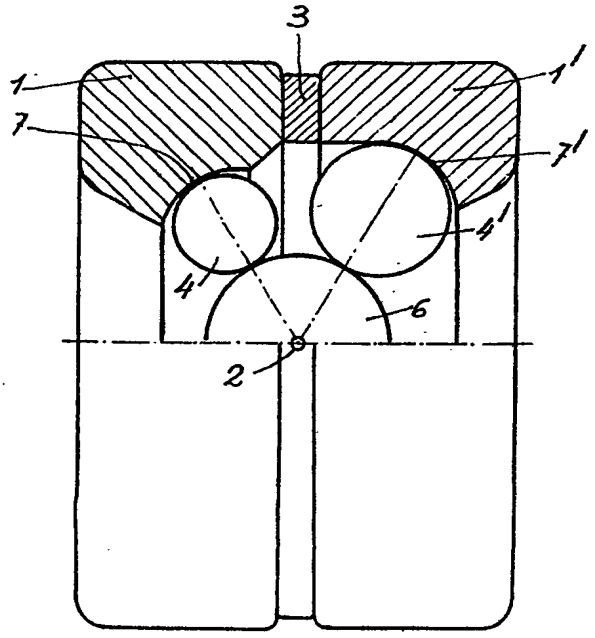

Fig. 2.

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